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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Paper No. 11

Application Number: 09/711,324
Filing Date: November 13, 2000
Appellant(s): KO ET AL.

Brick G. Power
For Appellant

MAILED

DEC 26 2001

GROUP 1709

EXAMINER'S ANSWER

This is in response to the appeal brief filed November 28, 2001.

(1) ***Real Party in Interest***

A statement identifying the real party in interest is contained in the brief.

(2) ***Related Appeals and Interferences***

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

The rejection of claims 1-38 stand or fall together.

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

5,626,716	Bosch et al.	5-1997
5,814,563	Ding et al.	9-1998

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding et al. (US 5,814,563) in view of Bosch et al. (US 5,626,716).

Ding teaches that a substrate may have a dielectric layer (e.g., doped (e.g., BPSG) and undoped silicon dioxide (e.g., TEOS)), see col. 1, lines 19-21. The substrate may be etched using a fluorohydrocarbon gas selected from the group consisting of CH_3F , CHF_3 , C_2HF_5 , $\text{C}_2\text{H}_2\text{F}_2$, and $\text{C}_2\text{H}_4\text{F}_2$ (col. 2, lines 62-64). Therefore, it would be obvious to one skilled in the art that CHF_3 and $\text{C}_2\text{H}_4\text{F}_2$ are **equivalent**, containing similar etching characteristics, substitution of one for the other for etching dielectric layer would have anticipated to produce an expected result. The above $\text{C}_2\text{H}_4\text{F}_2$ reads on the limitations of "comprising $\text{C}_2\text{H}_x\text{F}_y$, where x is an integer from 3-5, y is an integer from 1 to 3 and $x + y = 6$ " in the instant claims. The dielectric layer may comprise plurality of layers. (col. 3, lines 54-62). The etching process provides high etching rates and good etching selectivity ratios (col. 2, lines 22-35).

Unlike the claimed invention, Ding does not explicitly state that the dry etchant may be formulated to etch doped silicon dioxide with selectivity over (or at faster rate in instant claim 20) at least undoped silicon dioxide. In plasma etching of semiconductors, Bosch teaches that it is known that in dry etching process, the doped silicon oxide (such as the addition of the boron and phosphorous to the oxides) is etched at a faster rate than undoped silicon oxide (col. 2, lines 9-12). In addition, Bosch teaches a process for selectively etching a structure comprising doped silicon dioxide. The structure may be exposed to a fluorohydrocarbon etchant such as CHF_3 . The structure may be removed down to an etch stop adjacent the structure and comprising undoped silicon dioxide. The removing may take place without substantially removing the etch stop (col. 2, lines

37-43; col. 4, lines 44-48). As stated above, because Ding shows that CHF_3 and $\text{C}_2\text{H}_4\text{F}_2$ are **equivalent**, containing similar etching characteristics, substitution of one for the other for etching dielectric layer would have anticipated to produce an expected result. Therefore, one skilled in the art at the time of the invention would have found it obvious to modify Ding by using the principles of Bosch to formulate the etchant of Ding (such as $\text{C}_2\text{H}_4\text{F}_2$ and others as additives) in order to provide required etching selectivity ratios.

The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution. *Ex parte Novak* 16. USPQ 2d 2041 (BPAI 1989); *In re Mostovych* 144 USPQ 38 (CCPA 1964); *In re Leshin* 125 USPQ 416 (CCPA 1960); *Graver Tank & Manufacturing Co. v. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

Substitution of known equivalent structures. *In re Fout* 213 USPQ 532 (CCPA 1982); *In re Susi* 169 USPQ 423 (CCPA 1971).

As to claim 2 and 21, Bosch teaches doped silicon dioxide with selectivity over silicon nitride (col.2, lines 37-39). For the same discussion above, the etchant of Ding may be formulated to do so.

As to claims 3-7 and claims 22-26, Ding teaches these features (see col. 6, lines 1-14).

As to claims 8, 13, 27 and 32, Ding teaches using CH_2F_2 and CH_3F (col. 6, lines 1-14).

As to claims 9, 11, 16, 28, 30 and 35, Ding teaches using CF_4 and CHF_3 (col. 6, lines 1-14).

Claims 10, 12, 14, 15, 17, 18, 19, 29, 31, 33, 34, 36, 37, and 38 differ from the prior art by specifying various compositions or concentrations. However, the same materials are used and the process is alike. It is the examiner's position that a person having ordinary skill in the art at the time of the claimed invention would have found it obvious to modify Bosch and Ding by using various compositions and different concentrations because same were known to be result-effective variables, and routine experimentation would have been expected to optimize them.

(11) Response to Argument

With respect to claims 1-38, Appellants present four grounds that they believe warrant reversal of the examiner's rejection.

In appellants first argument (pages 7 and 10), appellants assert that there is no suggestion to combine the references. This argument is not persuasive. As has been stated above, Bosch teaches a process for selectively etching a structure comprising doped silicon dioxide using a fluorohydrocarbon etchant (e.g., CHF_3), the structure may be removed down to an etch stop comprising undoped silicon dioxide or silicon nitride, and Ding teaches that a substrate having a dielectric layer (e.g., doped (e.g., BPSG) and undoped silicon dioxide (e.g., TEOS)), may be etched using a fluorohydrocarbon gas such as CHF_3 and $\text{C}_2\text{H}_4\text{F}_2$. Therefore, it would be obvious to one skilled in the art that CHF_3 and $\text{C}_2\text{H}_4\text{F}_2$ are **equivalent**, containing similar etching characteristics, substitution of one for the other for etching dielectric layer would have anticipated to

produce an expected result. Hence, one skilled in the art would have found it obvious to substitute $C_2H_4F_2$ of Ding for CHF_3 of Bosch because Ding teaches that they are equivalent for etching dielectric layer and provide high etching rates and good etching selectivity ratios.

The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution. *Ex parte Novak* 16 USPQ 2d 2041 (BPAI 1989); *In re Mostovych* 144 USPQ 38 (CCPA 1964); *In re Leshin* 125 USPQ 416 (CCPA 1960); *Graver Tank & Manufacturing Co. v. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

Substitution of known equivalent structures. *In re Fout* 213 USPQ 532 (CCPA 1982); *In re Susi* 169 USPQ 423 (CCPA 1971).

In appellants second argument (page 9), appellants state that the group of fluorohydrocarbon gas is a very large group of various chemical genres and species the members thereof need only include carbon, fluorine, and hydrogen atoms. It is irrelevant to obviousness of claimed invention. Furthermore, Ding specifically disclose five fluorohydrocarbon gas may be used for dielectric layer etching as stated in the office action.

In appellants third argument (page 11), appellants state that the prior art both Bosch and Ding require the use of additional components. However, it reads on the limitation of "an etchant comprising $C_2H_xF_y$ " in the instant claims.

In appellants fourth argument (page 14), appellants state that the prior art does not teach that an etchant comprising $C_2H_xF_y$, where x is an integer from 3-5, y is an

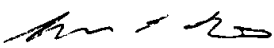
integer from 1 to 3 and $x + y = 6$, may be used to dry etch doped silicon oxide with selectivity over undoped silicon oxide. This point is respectfully but vehemently disagreed with. As stated in the previous office actions, $C_2H_4F_2$ of Ding reads on the limitations of "comprising $C_2H_xF_y$, where x is an integer from 3-5, y is an integer from 1 to 3 and $x + y = 6$ " in the instant claims. Appellants have not traversed on same. The discussion of combining Bosch and Ding from above (first argument) is repeated here. The combined prior art teaches that same may be used to dry etch doped silicon oxide with selectivity over undoped silicon oxide.



For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

K-C C

December 19, 2001


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